

REMARKS

By this amendment, Applicants have amended claim 2 to include therein the limitations previously recited in dependent claim 14 and to recite that the flow rate regulators are configured to provide more flow of the nitrogen oxide generation inhibiting gas to an air port close to the furnace center portion and to the air port close to the furnace side wall of the plurality of air ports. See, e.g., Figure 18 and the description thereof in Applicants' specification, especially the description in the paragraph bridging pages 35 and 36 of Applicants' specification. Claims 5-8 have been amended to be consistent with amended claim 2, claims 13 and 14 canceled without prejudice or disclaimer, and claims 15 and 16 amended to depend from claim 2.

Claims 2, 5-8 and 13-16 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,545,307 to Morita et al. Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to a combustion apparatus including a burner burning a fuel within a furnace in a theoretical air ratio or less and a plurality of air ports arranged downstream of the burner and placed along a width direction of the furnace. Each of the plurality of air ports is separated into a flow path injecting additional combustion air into the furnace and a flow path injecting a nitrogen oxide generation inhibiting gas in a mixing region formed by both of a combustion gas generated by burning the fuel by means of the burner and the additional combustion air injected from the air port or near the mixing region. The nitrogen oxide generation inhibiting gas is constituted by at least one gas selected from a group consisting of the combustion exhaust gas and a mixed gas of the combustion exhaust gas and air. The inhibiting gas

injection port is provided on an outer peripheral portion of the air injection port, at least a portion of the outer peripheral portion being on a burner side of the air injection port. Each air port includes a flow rate regulator, and the flow rate regulators are configured to provide more flow of the nitrogen oxide generation inhibiting gas to an air port close to the furnace center portion than to the air port close to the furnace side wall of the plurality of air ports. At least one blower is provided for circulating combustion exhaust gas from an outlet of the furnace to an inlet of the flow path injecting a nitrogen oxide generation inhibiting gas, and for supplying the additional combustion air to the flow path injecting additional combustion air into the furnace.

Figure 1 of the Morita patent shows a schematic view of a conventional two-stage combustion apparatus, including a burner zone 53 of a combustion furnace 51 and after air ports 57 provided downstream of the burners. However, the Morita et al. patent appears to teach away from such a construction at column 1, lines 61-63. Instead, the Morita et al. patent proposes the burner construction shown, e.g., in Figures 3 and 4. That is, the Morita et al. patent discloses a coal combustion apparatus, which apparatus comprises a pulverized coal-feeding pipe inserted into a burner throat on the lateral wall of a combustion furnace and for feeding the coal and air into the furnace; a means for feeding the coal and air into the coal pipe; a secondary air passageway formed between the coal pipe and a secondary air-feeding pipe provided on the outer peripheral side of the coal pipe; a ternary air passageway formed on the outer peripheral side of the secondary air-feeding pipe; a means for feeding air or an oxygen-containing gas into the secondary air passageway and that into the ternary air

passageway; and a bluff body having a cross-section of a L-letter form provided at the tip end of the coal pipe.

While the Office Action appears to simultaneously rely on Figures 1-3 of Morita et al., it is submitted Figures 1 and 2 of Morita et al. represent, respectively, a conventional two-stage combustion apparatus and a conventional coal combustion apparatus (burner), while Figure 3 represents the coal combustion apparatus (burner) of the invention of Morita et al. That is, it does not appear that Figures 1, 2 and 3 disclose elements of combustion apparatus usable together.

It is submitted the combustion apparatus of Figure 3 of Morita et al. represents a type of burner, including a pulverized coal pipe 8 and primary, secondary and ternary air passageways. While it disclosed that, as the primary, secondary and ternary airs, air, combustion, exhaust gas, mixtures thereof, etc. may be used, it is not disclosed that different gases should be used as the respective primary, secondary and ternary airs. Moreover, it is not disclosed that the combustion apparatus of Figure 3 should be used with after air ports 57 of Figure 1 of Morita et al. Thus, it is submitted the Morita et al. patent does not disclose the combustion apparatus of the present invention, including a burner for burning the fuel within the furnace at a theoretical air ratio or less and a plurality of air ports (i.e., after air ports) arranged downstream of the burner.

Certainly, the Morita et al. patent does not disclose a plurality of air ports arranged downstream of a burner and placed along a width direction of the furnace. According to the present invention, each of the air ports includes a flow rate regulator, and the flow rate regulators are configured to provide more flow of the nitrogen oxide generation inhibiting gas to an air port close to the furnace center portion then to the air

port close to the furnace side wall of the plurality of air ports. Such is neither disclosed nor suggested by Morita et al.

Nor is the present invention obvious over Morita et al., alone in view of any other prior art of record. On page 4 of the Office Action mailed May 19, 2009, the Examiner alleges that the Garcia-Mallol discloses the features previously recited in claim 14. However, Garcia-Mallol discloses a flow rate regulation within one air control system, which does not regulate the flow rate of each of a plurality air ports provided in a width direction, such as in the present invention. Since the combustion gas from the burner zone does not flow to the back flow side in a uniform mixed state, the arrangement presently claimed can regulate the flow rate in correspondence to the non-uniform gas state in accordance with the place in the width direction, and can effectively suppress nitrogen oxide generators.

For the foregoing reasons, the presently claimed invention is patentable over Morita et al.

Claims 10 and 11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. in view of U.S. Patent No. 4,135,874 to Tsuzi et al. Applicants traverse this rejection and request reconsideration thereof.

The Tsuzi et al patent discloses a furnace whose NOx emission may be reduced by optimally controlling the ratio of exhaust gas mixed with the combustion air to be supplied to the burners to the exhaust gas to be mixed with the two-stage combustion air which is admitted through air nozzles into the combustion chamber and also by optimally controlling the distribution of the two-stage combustion air in the combustion chamber depending upon the operating conditions.

However, in Tsuzi et al, it appears a single mixture gas is introduced through each two-stage combustion air injection nozzle. This type of arrangement may suffer from the deficiency described at page 5, lines 17-23 of applicants' specification, i.e., that it may be necessary to supply a lot of exhaust gas or low-temperature air for lowering the temperature of the high-temperature combustion gas in the upper portion of the burner within the furnace. Accordingly, a power generation efficiency of the plant may be significantly reduced.

On the other hand, air port arranged downstream of the burner of the present invention is separated into a flow path injecting additional combustion air into the furnace and a flow path injecting a nitrogen oxide generation inhibiting gas in the mixing region. This is not disclosed by Tsuzi et al. Accordingly, the Tsuzi et al patent does not remedy the deficiencies noted above with respect to Morita et al.

Therefore, the presently claimed invention is patentable over the proposed combination of Morita et al. and Tsuzi et al.

Claim 12 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Morita et al. in view of Tsuzi et al. and U.S. Patent No. 5,231,937 to Kobayashi et al. Applicants traverse this rejection and request reconsideration thereof.

The Kobayashi et al. patent has been cited by the Examiner as allegedly teaching that is known to lower the temperature of an exhaust gas by means of a heat exchanger. However, since claim 12 ultimately depends from claim 2, it is submitted claim 12 is patentable at least for the reasons noted above with respect to claim 2.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

500.45104X00

Please charge any shortage in the fees due in connection with the filing of this paper, including excess claim fees, to Deposit Account No. 01-2135 (500.45104X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

/Alan E. Schiavelli/
Alan E. Schiavelli
Registration No. 32,087